

## ACTIVITY RHYTHM AND HOME RANGE OF ALPINE WEASEL \*

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### Abstract

The activity rhythms and home ranges of alpine weasels were studied by telemetric techniques in 1990 at YUER mountain near Haibei Research Station of Alpine Meadow Ecosystem. The main activities of alpine weasels were as follows: play, self-groom, sunbath, explore, feed, and care of young during the breeding period. In June, the young did not come out of the dens, the daily activity peaks of adult females were 11:00~13:00 hrs and 16:00~17:00 hrs, and of adult males were 11:00 hrs; the home range sizes of adult females were 7.21 ha. and of adult males were 11.7 ha. In July, the young moved on the ground, the activity peaks of adult females were 8:00~9:00 hrs and 17:00~19:00 hrs, the home range size of adult females was 82.72ha. The activity peaks of adult females changed into 8:00~9:00 hrs and 15:00~20:00 hrs in August when the young dispersed. The factors influencing their activity and home range size were food abundance, prey activity, breeding behaviour and population density.

**Key words** Alpine weasel (*Mustela altaica*); Activity rhythm; Home range

Alpine weasels are secondary consumers, they mainly select alpine meadow to live in and plateau pika to feed on, their breeding period is from May to August, the care of young is completed only by the females (Wei et al., 1994). Their population energy dynamics and gas metabolism also have been studied (Liang et al., 1986a, b). This paper mainly deals with their activity rhythms and home range sizes.

### STUDY AREA AND METHODS

#### 1. Study area

Field works were carried out in 1990 at YUER mountain near Haibei Research Station of Alpine Meadow Ecosystem. YUER mountain is northwestern direction, about 5 120 meters long and 2 100 meters wide. It is surrounded by water and swamp. The geo-

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graphical features, vegetation and rodent community of this place had been reported by Yang (1982), Zhou et al. (1982) and Liu et al. (1982).

## 2. Methods

Weasels were captured with wooden boxes, iron cages and nooses which were designed by ourselves, and immobilized with ketamine hydrochloride (30 mg/kg bw). Animals were fitted with 2 g collar transmitters and allowed to recover fully from anesthesia before releasing. The life of transmitters was about 8 months, the frequencies of them were between 164.000 and 164.999 MHz. Nine female and eight male weasels were marked. The mean weight of the females was  $101.6 \pm 5.2$  g, and of the males,  $179.1 \pm 37.2$  g. Radio-tracking consisted of simple signal-following with hand-held Yagi antennas. We recorded time the weasels spent above ground and marked the locations the animals emerged for 24 hrs with small flags. The elliptic method (Sun et al., 1982) was used to determine the daily activity range. The home range size was calculated by the minimum convex-polygon method (Xia, 1961).

Pika density was determined by direct enumeration on each random 0.25 hectare when pika was at activity peak.

## RESULTS

### 1. Activity

(1) Characteristics of activities The alpine weasels were agile and moved in jumping way. Except breeding period, they were solitary. They occupied pika's holes as their dens and often changed living places. Their activities were as follows:

**Play** It consisted of jumping, running and somersaulting. The male weasels displayed this behaviour more than the female animals.

**Self-groom** The animals cleaned the body surface with paws or mouth. It usually occurred when the weasels started their aboveground activity.

**Sunbath** The head was out of the holes, or the body lied near the entrance of the hole, the face was toward the sunshine.

**Explore** The animals upstanced with front feet off the ground and looked around. This behaviour appeared most frequently during the breeding period for nursing female weasels.

**Feed** It included search, kill, carry and ingest food. The weasels frequently searched the pika's holes or pursued active pikas on the ground to look for food. After they caught the prey, the weasels killed it and carried it to the dens or to the hoarding places.

**Care of young** Its behaviour pattern was protect, feed and carry of young. The mothers carried their young to a safe place when they sensed danger by picking them up carefully in their mouth. When the young were older, the mothers carried their young in group.

(2) Daily activity rhythm From early of June to late of August, the weasels were

diurnal animals. As showed in Fig. 1 and Fig. 2, the activity rhythms of the adult females were "two-peak" pattern, and of the adult males, "one-peak" pattern. In June, the young did not come out of the dens. The aboveground activity and the frequency of entering the dens of the adult females averaged 144.7 minutes/day and 8.5 times/day, respectively; the activity peaks were 11:00~13:00 and 16:00~17:00 hrs. During the first peak, adult females mainly searched and carried the food to the dens or hoarding places, and carried the hoarding food to the dens during the second peak. In the middle of the first peak, the mothers often returned to the dens to feed their young, this decreased their activity. The activity peak of the adult males was 11:00 hrs and the time of their starting aboveground activity was apparently later than that of the adult females, but there was much higher level of activity. In July, the young began to move on the ground. the aboveground activity and the frequency of entering the dens of the adult females averaged 210.5 minute/day and 16.9 times/day, respectively; the activity peaks were 8:00~11:00 and 17:00~19:00 hrs. The young dispersed in August, the aboveground activity and the frequency of entering the dens of the adult females averaged 363.5 minutes/day and 3.75 times/day, respectively; the activity peaks were 8:00~11:00 and 15:00~20:00 hrs.

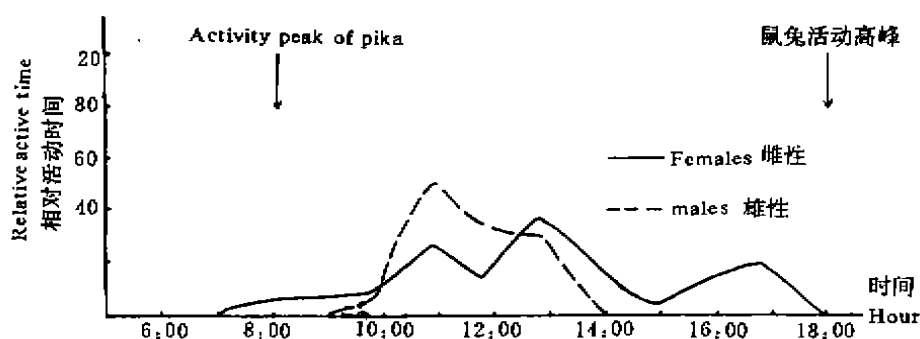


Fig. 1 Daily activity rhythms of the alpine weasels in June

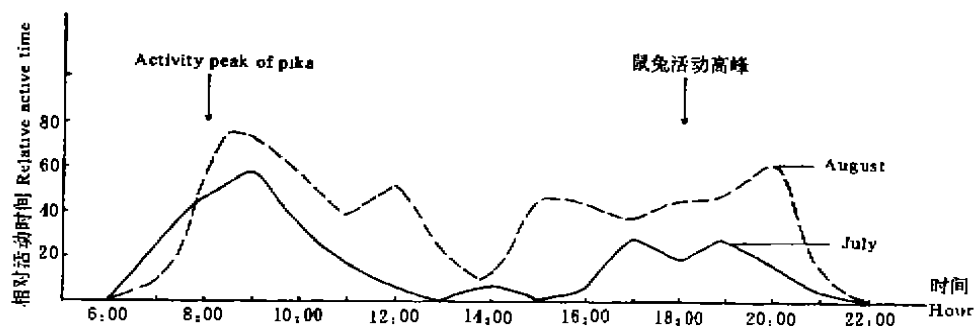


Fig. 2 Daily activity rhythms of female alpine weasels in July and August

Weather affected the aboveground activity of the weasels. When it was windy and cloudy, the weasels decreased the aboveground activity. ♀ 7 did not come out of the

dens because it rained continuously during 5 July~6 July, but when it was clear after raining, they were more active.

## 2. Home range

The pattern of the home ranges of the female weasels remained stable during the breeding period and so did that of the male weasels until early July. In June, the home range size of adult females (♀2, ♀3, ♀4, ♀6, ♀7, ♀8) averaged  $7.21 \pm 0.75$  ha., significantly differed from that of adult males (♂1, ♂5) which averaged  $11.7 \pm 2.1$  ha. ( $t = 2.657 > t_{0.05} = 1.943$ ). Meanwhile, the home range size of the weasels was  $6.86 \pm 0.81$  ha. on the place where pika density was 23 individuals/ha and  $10.8 \pm 1.51$  ha. on the

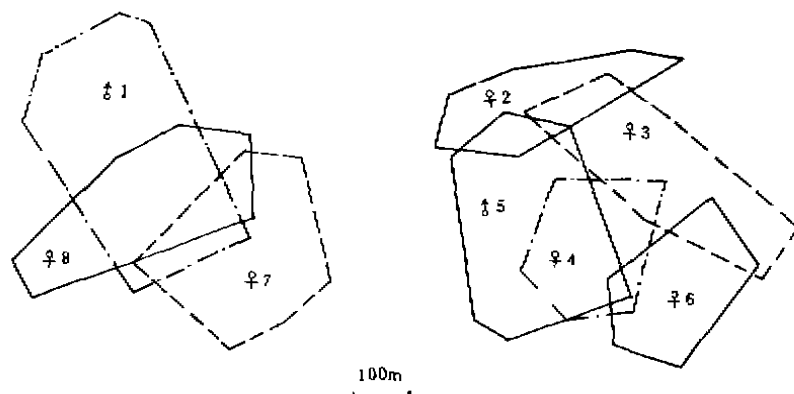


Fig. 3 The home ranges of the alpine weasels in June

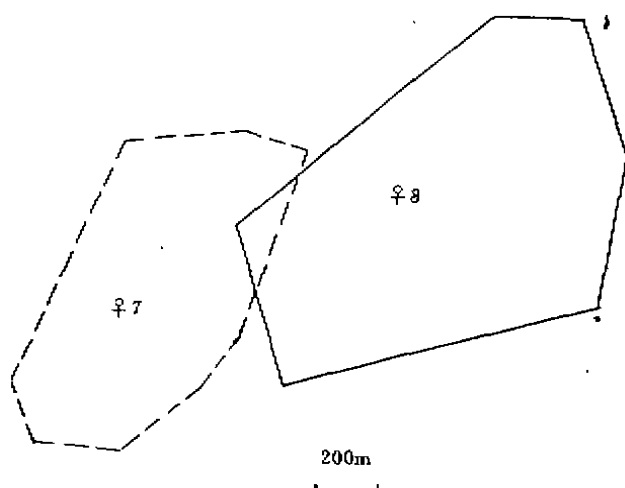


Fig. 4 The home ranges of the female alpine weasels in July

place where pika density was 17 individuals/ha. In July, all female weasels shifted their home range places except for ♀8 and obviously enlarged their home range sizes (averaged  $82.72 \pm 20.28$  ha.). These differed significantly from that of in June ( $t = 7.820 > t_{0.01} = 3.143$ ). All male weasels had no fixed home ranges and they often changed daily activity places. In August, all adult females and yearlings were the same as males in range sizes.

The daily activity ranges of the weasels varied greatly. The area of ♀8 on 15 July was 3.9 times that of on 6 August, of ♀3 on 9 August was 11.9 times that of on 10 August and, of ♂9 on 14 August was 12.7 times that of on 18 August. In July, the daily activity area of the females averaged  $31.2 \pm 13.9$  ha.. In August, the daily activity area of the females averaged 5.2 ha., and of the males, 5.4 ha.. There was no significant difference be-

tween the males and females ( $t=0.040 < t_{0.05}=2.353$ ).

The home ranges of the weasels overlapped to some extent, but all had a more or less exclusive area (Fig. 3 and Fig. 4). As showed in Fig. 3, the home range of ♂ 1 overlapped with those of ♀ 7 and ♀ 8, the home range of ♂ 5 overlapped with those of ♀ 2, ♀ 3, ♀ 4 and ♀ 6. The degree of overlapping apparently varied between individuals and, in the same individual, at different times. Observations indicated that the home range overlap was spatial, not temporal, two weasels seldom met.

## DISCUSSION

### 1. The activity in relation to food abundance and reproduction

The activity of the alpine weasels is similar in several respects to that of other closely related mustelids (Goransson, 1983; Xie et al., 1990; Zheng et al., 1988). In the mustelids, some animals were nocturnal, some were diurnal and most of them changed their activity time with season (Sheng et al., 1982; Zheng et al., 1983; Xia et al., 1990; Gerall, 1969; Weber, 1989). The alpine weasels were diurnal animals during breeding period and shifted their activity to night after their young dispersed.

Food abundance, prey activity and weather influenced the activity of the mink (*Mustela vison*) and black-footed ferret (*Mustela nigripes*) (Copenhagen, 1970; Richardson et al., 1987; Biggins et al., 1986), they also affected the activity of the weasels. Available rodents were plateau zokor (*Myospalax baileyi*), plateau pika (*Ochotona curzoniae*), gansu pika (*O. cansus*) and root vole (*Microtus oeconomus*), but the weasels mainly feed on the plateau pika (Wei et al., 1994). During the pika's breeding period, its number obviously increased and its young had lower activity, the weasels fed on broods of young pikas in the holes. This provided a good opportunity of predation for the weasels. They spent little time and energy for searching and capturing the preys from which they could obtain enough food. So the activity of the weasels was not influenced by that of pika. After July, the pika's number decreased and young pika grew into sub-adult or adult, the weasels began to feed on pika on the ground; because prey's activity increased and its number decreased, the weasels had to spend more time and energy for searching and capturing prey. So the activity of the weasels was in synchrony with that of pika. After October, the number of pika was seriously decreased, the weasel had to feed on small birds and root voles. The small birds dwelled in the thick grass or rodent's abandoned holes at night; the root voles were active at day and night. So the weasels became nocturnal animal in autumn and winter.

The activity of the weasels was also affected by their breeding behaviours. This conclusion is supported by Richardson et al. (1987). Before the young came out of the dens, the males still occupied the same places with the females until the young moved on the ground, the nursing was one of the mother's activity. We observed that when a mother searched for food for a long time, even if she failed to capture any prey, she had to come back on time. In the meantime, the activity rhythm of adult females, compared

with that of the adult males, had great difference, and the activity time of females was longer than that of the males. After the young moved on the ground, the young increased the locomotive ability and the mother frequently moved them; this increased the mother's activity. So the activity time and frequency of entering the dens of the females were significantly longer and higher than those of former period. When the young began to disperse, the mother decreased the nursing intensity, so the frequency of entering the dens of the females was the lowest, but activity time of them was the longest.

## 2. The major factors affecting home range size

The home range is an important index to describe animal activity. This paper adopt the Burt's definition (1943) that "home range is the area over which an animal normally travels in pursuit of its routine activities". In general, it was thought that the stable home range made the animal spend little energy to obtain enough foods and safe shelters. The alpine weasel was a kind of animal with sexual dimorphism, the males are larger and need more energy. They increased their activity areas so that they could obtain more food and mate with many females during the breeding period, their home range size depended on the distribution of the females. The females had the stable home range so that they could successfully nurse their offspring. Copenhagen (1970) pointed out that the adult female minks preferred the areas near the dens and they kept within a smaller range than the adult males when they were pregnant. The female weasels also displayed this pattern. This difference was caused by different behaviour between the females and males.

Many data (King, 1975, 1980; Weber, 1989,) showed that home range size related to food abundance. Our field observations also indicated the weasels had smaller home range in those places where pika density was higher. Besides this, the home range size of the weasels was affected by the maternal behaviours and feeding strategy. Before the young came out of the den, adult females' activity was constrained by caring for the young and they fed mainly on broods of young pikas, so their home range sizes were relatively small and there was not significant difference between individuals. After the young moved on the ground, pika density decreased, so the female weasels had to extend their activity range to search food.

The most important factor affecting the size of the home range is assumed to be the population pressure as a function of population density in relation to carrying capacity of the area (Copenhagen, 1970). Investigations of Marters (Hawley et al., 1957) and black-footed ferrets (Richardson et al., 1987) supports this assumption. Before the young came out of the dens, there were 5 alpine weasels in the area of 25 hectares and 3 alpine weasels in another area of 30 hectares. The former had high density and intraspecies pressure, thus, small home range sizes; on the contrary, the later had large home range size. After the young came out of the den, there were two litters from the middle to southern end of sun-side of YUER mountain, so the weasels had small intraspecies pressure, their home range sizes were obviously larger.

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## 香鼬的活动节律和巢区

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## 摘 要

本文采用无线电遥测技术对栖息在自然环境中香鼬 (*Mustela altaica*) 的活动节律及其巢区进行了较为系统的研究。结果表明, 香鼬多营独居生活, 除繁殖期外, 无论雌雄个体均无长期稳定的巢穴, 经常更换活动的位置。香鼬的每日活动主要为玩耍、自身的修饰、光浴、探视和取食, 在繁殖期还有育幼及对幼鼬的保护。在不同时期香鼬日活动高峰和巢区大小均有不同。幼鼬出洞活动前, 其亲体雌性成鼬活动呈现两个明显的高峰, 11:00~13:00 和 16:00~17:00, 雄性成鼬则只有一个活动高峰在 11:00 左右; 在这一时期, 成体香鼬的地面活动高峰与其食物——高原鼠兔的地面活动高峰不相吻合, 雌性成鼬的巢区面积为 7.21 ha, 雄性成鼬的巢区面积为 11.7 ha。幼鼬出洞活动后, 雌性成鼬的活动高峰为 8:00~9:00 和 17:00~19:00, 巢区面积平均为 82.72 ha。幼鼬扩散期间, 雌性成鼬的活动高峰期分别为 8:00~9:00 和 15:00~20:00。在这两个时期, 成体香鼬的地面活动高峰与高原鼠兔的地面活动高峰趋于一致。影响香鼬活动和巢区大小的主要因素是食物的丰富度、猎物的活动性和繁殖行为, 同时种群密度也是主要因素之一。

关键词 香鼬; 活动节律; 巢区

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